

**Population Survey of the Oyster
Crassostrea virginica in the Dunk River
Estuary, Prince Edward Island, 1972**

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CRASSOSTREA VIRGINICA IN THE DUNK RIVER ESTUARY,
PRINCE EDWARD ISLAND, 1972

by

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ABSTRACT

Hawkins, C.M. and T.W. Rowell. 1985. Population survey of the oyster Crassostrea virginica in the Dunk River Estuary, Prince Edward Island, 1972. Can. MS Rep. Fish. Aquat. Sci. 1858: iv + 59 p.

This report is the second in a series of seven which examine temporal changes in the oyster population of the Dunk River, Prince Edward Island. The report tabularizes and graphically presents information on the distribution, abundance, size, and age composition of oysters collected in 1972. Oyster density over the surveyed area ranged from 0-427 m⁻². Sixty-six percent of the sampling stations yielded oysters. Oysters 1, 2, and 4 yr old and older accounted for 31.8%, 30.5%, and 22.5% of the sampled population respectively. Oysters 3 yr old represented only 15.3% of the population. Size frequency histograms for individual stations indicated that spatfall settlement and survival was more regular in the principal fishing areas than in other areas of the Estuary.

RÉSUMÉ

Hawkins, C.M. and T.W. Rowell. 1985. Population survey of the oyster Crassostrea virginica in the Dunk River Estuary, Prince Edward Island, 1972. Can. MS Rep. Fish. Aquat. Sci. 1858: iv + 59 p.

Le présent document est le deuxième d'une série de sept rapports portant sur les changements temporels qui touchent la population d'huîtres de la rivière dunk, Ile-du-Prince-Edouard. La rapport présente des renseignements sous forme de tableaux et de graphiques concernant la distribution, l'abondance, la taille et l'âge des huîtres capturées en 1972. La densité des huîtres dans la région étudiée a varié entre 0 et 427 par m². Des huîtres ont été capturées dans 66% des stations d'échantillonnage. Les huîtres âgées de un, deux et quatre ans et plus représentaient respectivement 31,8%, 30,5%, et 22,5% de la population échantillonnée. Les huîtres âgées de 3 ans ne représentaient que 15,3% de la population. Les histogrammes de fréquences de la taille dans le différentes stations indiquent que la fixation des larves sur un support et la survie sont plus régulières dans les principales zones de pêche que dans les autres régions de l'estuaire.

INTRODUCTION

This report is the second in a series of seven designed to examine the population structure of the oyster, Crassostrea virginica, in the Dunk River Estuary, Prince Edward Island. This long-term monitoring program, begun in 1969, was intended to provide detailed information on the size composition, distribution, and abundance of oysters in the Estuary. The following data summarize the information collected in the August 1972 survey.

MATERIALS AND METHODS

Hawkins and Rowell (1985a) provide a detailed description of the sampling procedure and materials and methods of data acquisition. However, diver reconnaissance information on substrate type and on fauna and flora surrounding each sample site was not recorded in 1972. In addition, only length measurements on live oysters were taken from the material collected within each square meter sample. The field program was carried out in the period from August 24-28, 1972. Figure 1 shows the positions of the 13 transects and their respective sampling stations in the Dunk River Estuary. A total of 148 stations were occupied in an area of approximately 300 ha.

RESULTS AND DISCUSSION

The stations sampled along each transect are listed in Table 1 along with oyster density per square meter, size range, mean size (in centimeters), and standard deviation. Over all stations, oysters ranged in size from less than 0.5 cm to 15.5 cm. Density of oysters per square meter at each sampling station is shown in Figure 2. Overall, the density of oysters ranged from 0-472 individuals m^{-2} . In 54% (80 stations) of the stations occupied, no live oysters were found. Transects K (Stations 128-134) and M (Stations 140-148) were the only ones along which no live oysters were collected.

Following the oyster density classification proposed by Lavoie (1977), the 1972 data show that 65.5% of the 148 stations examined have low densities ($\leq 10 m^{-2}$), 22.3% have intermediate densities (11-100 m^{-2}), and 12.2% have high densities ($> 100 m^{-2}$). Lavoie suggests that areas of intermediate oyster density are preferred by fishermen, since these areas yield good-quality oysters while requiring little culling effort. While this consideration may be significant in a market-direct fishery, it does not apply to the same degree in a relay fishery, such as that in the Dunk River, where the cull size is smaller. Density information based on size (length) and age is more useful in determining oyster availability to the fishery and in following recruitment patterns. In comparison to similar data collected in previous years (Hawkins and Rowell 1985a), the percentage of stations with low density in 1972 (65.5%) was similar to 1969 (66.4%) but markedly different from 1970 when no low-density stations were encountered. The percentage of stations with intermediate density classification was similar in 1972 (22.3%) to those in 1969 (25.5%) and 1970 (25.0%). The percentage of stations with

high density in 1972 (12.2%) was considerably different from 1969 (8.1%) and 1970 (75.0%). Note that comparisons with the 1970 data must be viewed with some caution, since in that year sampling stations were limited to the area of known fishing.

Figures 3a, b, c, and d show the numerical density of 1, 2, 3, and 4+ yr old oysters respectively. Ages were approximated, based on the growth equation established by Lavoie and Bryan (1981). Figures 4a, b, c, and d express the same data as a percentage of the total number of oysters collected at each station. Approximately 26% (1,395 individuals) of the total number of oysters collected in the survey (5,227 individuals) were greater than or equal to 2.5 inches (6.5 cm), the cull size for the relay fishery, while about 16% (836 individuals) were equal to or greater than the market size of 3 inches (7.6 cm). From Figure 4a it can be seen that 1 yr old oysters (≤ 2.5 cm) comprise over 25% of the oysters collected in 21.6% (32 of 148 stations) of the total number of stations examined. Figure 4b shows that at 26.5% of the 148 stations examined, 2 yr old oysters (2.6-4.5 cm) made up between 26-100% of the oysters collected. Three year old oysters (4.6-6.5 cm) were less abundant and did not predominate in as large a percentage of the stations examined. Oysters 4 yr old and older (6.5 cm) comprised more than 25% of the oysters collected in 19.6% of the stations examined.

Histograms, showing the size distribution at each station with more than 10 individuals m^{-2} , are presented in Figure 5. Lower densities were not considered representative of populations within a square meter quadrat. As in 1969 and 1970 (Hawkins and Rowell 1985a), size frequency distributions for individual stations within the two principal fishing areas received more regular spatfall settlement and probably have better recruitment survival than do other areas within the Estuary. This is indicated by the wide size range of oysters collected at each station in each of the two areas (Stations 10, 11, 12, 22, 49-52, and 67-70) combined with similar patterns in the overall size frequency distribution among stations within each area. Areas outside the main fishing region exhibit more marked irregular patterns in both the overall size frequency distributions among stations and the size range of oysters collected at each station.

Figure 6, a composite size frequency histogram constructed from all data, provides a means of comprising the 1972 population size structure with those observed in previous and subsequent years (Hawkins and Rowell 1985a, b, c, d, e, and f). The population size structure in 1972 shows a bimodal distribution pattern. One and 2 yr old oysters together form the most prominent mode and comprise 62.2% of the sampled population. Three and 4+ yr olds account for the remainder of the sampled population and form the much smaller second mode. The relatively high number of 1 and 2 yr old oysters could reflect either good spatfall and settlement, as well as good post-settlement survival, or a combination of both. The 1972 population structure is similar to that observed in 1970, but differs from that of 1969 when only a single mode was seen. In 1969, the mode was primarily composed of 2 yr olds (2.6-4.5 cm); and in 1970 the two modes were largely comprised of 1 and 3 yr olds respectively. All subsequent years but 1973 had population structures similar to that in 1972 (Hawkins and Rowell 1985b, c, d, e, and f). Additionally, the 1972 frequency value for the most prominent mode is among the highest when compared to other years.

SUMMARY

1. Oyster density ranged from 0-472 individuals m^{-2} , 65.5% of the stations having low densities ($\leq 10 m^{-2}$), 22.3% having intermediate densities (11-100 m^{-2}), and 12.2% having high densities ($> 100 m^{-2}$).
2. The population structure for 1972 showed 1 yr old (≤ 2.5 cm) and 2 yr old (2.6-4.5 cm) oysters together comprising 62.3% of the total population, 1 yr olds accounting for 31.8% and 2 yr olds accounting for 30.5%. Three year olds (4.6-6.5 cm) represented only 15.3% of the population.
3. Between 1970 and 1972, the 1969 year class dropped from 44.9% to 15.3% of the population, suggesting a high mortality and (or) significant removals of this year class.
4. Spat settlement and (or) survival of both the 1970 and 1971 year classes appears to have been good. This was particularly so for the 1970 year class.
5. Size frequency distributions for stations in the principal fishing areas indicate that spatfall settlement and recruitment success were more regular than in areas outside the principal fishing regions.

ACKNOWLEDGEMENTS

We wish to thank R.E. Lavoie for planning and implementing the survey and C.F. Bryan for his assistance in collecting and processing field samples. B. Mullen and D. Whillans assisted in data processing and graphic presentation.

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Table 1. Density per square meter, range of 0.5 cm size classes, mean size (in centimeters), and standard deviation of oysters collected at each station in 1972.

Transect line	Station number	Number m^{-2}	Range of 0.5 cm size classes	Mean size (cm)	Standard deviation
A	1	0			
	2	0			
	3	0			
	4	1	14.5-15.0	15.0	
	5	0			
	6	0			
	7	0			
	8	0			
	9	5	2.5- 9.5	6.30	2.71
	10	84	0.0-11.0	4.60	2.93
	11	24	1.5- 7.0	4.33	2.39
	12	257	0.0-10.5	3.88	2.28
	13	0			
	14	0			
B	15	0			
	16	0			
	17	0			
	18	0			
	19	0			
	20	5	2.0- 7.0	5.20	1.68
	21	59	0.0-10.5	5.07	2.46
	22	95	0.5-11.5	4.80	2.72
	23	7	0.5- 2.5	1.57	0.73
	24	0			
C	25	0			
	26	0			
	27	0			
	28	0			
	29	0			
	30	0			
	31	0			
	31	0			
	33	0			
	34	1	0.0- 0.5	0.5	
	35	32	1.0-13.5	5.16	3.37
	36	20	1.5- 9.5	5.28	2.28
	37	1	7.5- 8.0	8.0	
	38	23	0.5- 9.5	4.33	2.33

... Cont'd



Table 1. Cont'd.

Transect line	Station number	Number m^{-2}	Range of 0.5 cm size classes	Mean size (cm)	Standard deviation
D	39	0			
	40	11	2.5-15.5	5.73	4.03
	41	0			
	42	0			
	43	0			
	44	0			
	45	22	1.5-14.5	7.14	3.64
	46	26	1.0- 9.0	5.73	1.94
	47	40	1.0- 9.0	4.75	2.88
	48	24	2.0-12.5	5.33	3.57
	49	216	0.5- 7.5	3.54	2.00
	50	280	0.5-11.0	4.66	2.58
	51	168	0.5-13.0	6.06	3.40
	52	168	1.0-10.5	5.07	2.45
	53	472	0.5-12.5	3.51	2.57
	54	0			
	55	136	0.5-13.0	4.94	3.58
	56	320	1.0-10.0	4.35	2.29
	57	0			
E	58	0			
	59	3	1.0- 4.0	2.67	1.26
	60	8	1.5-11.0	5.44	3.16
	61	344	0.5- 9.5	4.87	2.34
	62	0			
	63	30	1.0- 9.0	4.03	2.18
	64	39	0.0- 8.5	4.46	2.20
	65	209	0.5-10.5	4.79	2.94
	66	144	1.0-10.5	5.13	3.06
	67	131	0.0-12.0	4.49	2.77
	68	139	1.0-11.0	4.50	2.32
	69	180	0.5-10.5	4.78	2.78
	70	244	0.5-11.5	4.79	2.51
	71	13	1.5- 8.0	4.42	2.14
	72	0			
	73	20	1.5-13.0	5.23	2.48
	74	0			
F	75	0			
	76	0			
	77	40	0.5- 9.0	4.99	2.60
	78	3	1.5-11.0	5.83	4.65
	79	80	1.0-13.0	4.25	2.55
	80	26	1.5- 9.0	5.87	2.01
	81	14	1.5-14.0	7.04	3.72

...Cont'd.

Table 1. Cont'd.

Transect line	Station number	Number m^{-2}	Range of 0.5 cm size classes	Mean size (cm)	Standard deviation
	82	53	1.0-12.0	5.25	2.72
	83	116	1.0-10.5	4.47	2.67
	84	120	1.0-10.0	4.58	2.30
	85	21	1.0-11.0	4.40	2.98
	86	0			
	87	12	0.5-11.5	4.46	3.67
	88	0			
G	89	0			
	90	12	2.0- 8.5	4.21	1.68
	91	2	4.5-14.0	9.50	6.36
	92	36	1.0-14.5	6.46	3.52
	93	4	2.0- 8.5	4.25	2.84
	94	0			
	95	2	7.5- 9.0	8.50	0.71
	96	0			
	97	0			
	98	1	2.5- 3.0	3.0	
	99	0			
	100	0			
	101	0			
	102	88	1.0-12.5	4.43	2.52
	103	0			
H	104	0			
	105	0			
	106	0			
	107	0			
	108	0			
	109	0			
	110	0			
	111	0			
	112	1	2.5- 3.0	3.0	
	113	31	0.5- 8.0	4.68	1.84
I	114	0			
	115	0			
	116	15	3.0-11.5	6.63	2.27
	117	40	2.0-12.0	5.96	2.62
	118	26	1.0-12.0	5.38	2.79
	119	0			
	120	0			

...Cont'd.

Table 1. Cont'd.

Transect line	Station number	Number m^{-2}	Range of 0.5 cm size classes	Mean size (cm)	Standard deviation
J	121	0			
	122	3	4.5- 6.5	5.67	0.76
	123	46	1.5-10.0	5.03	2.19
	124	24	1.5- 9.5	4.29	2.45
	125	29	1.0-13.5	4.86	3.15
	126	0			
	127	380	1.0-13.0	4.14	2.40
	128	0			
K	129	0			
	130	0			
	131	0			
	132	0			
	133	0			
	134	0			
L	135	0			
	136	0			
	137	0			
	138	0			
	139	1	8.5- 9.0	9.0	
M	140	0			
	141	0			
	142	0			
	143	0			
	144	0			
	145	0			
	146	0			
	147	0			
	148	0			

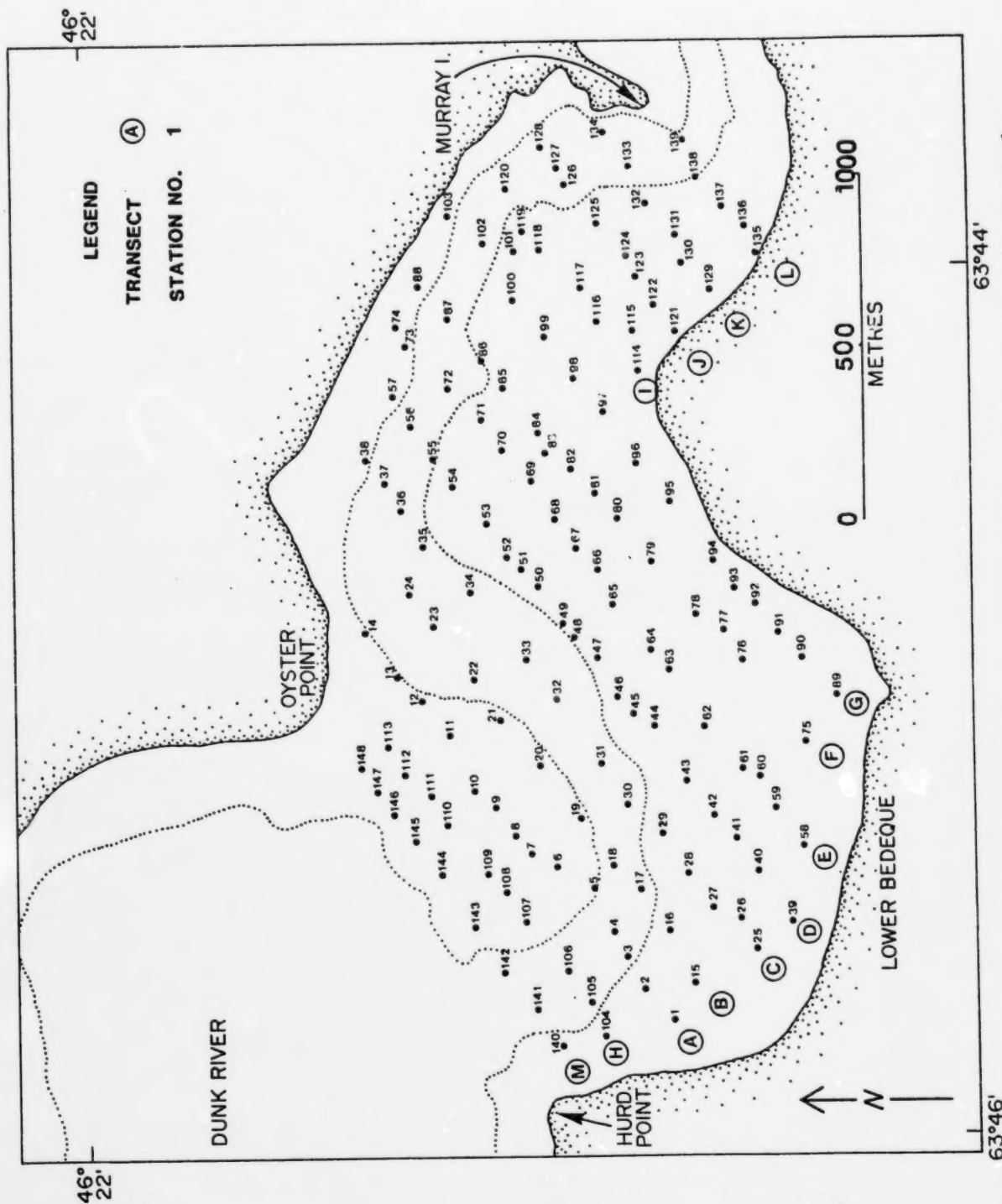


Figure 1. Positions of transects and their respective sampling stations in the Dunk River Estuary, 1972.

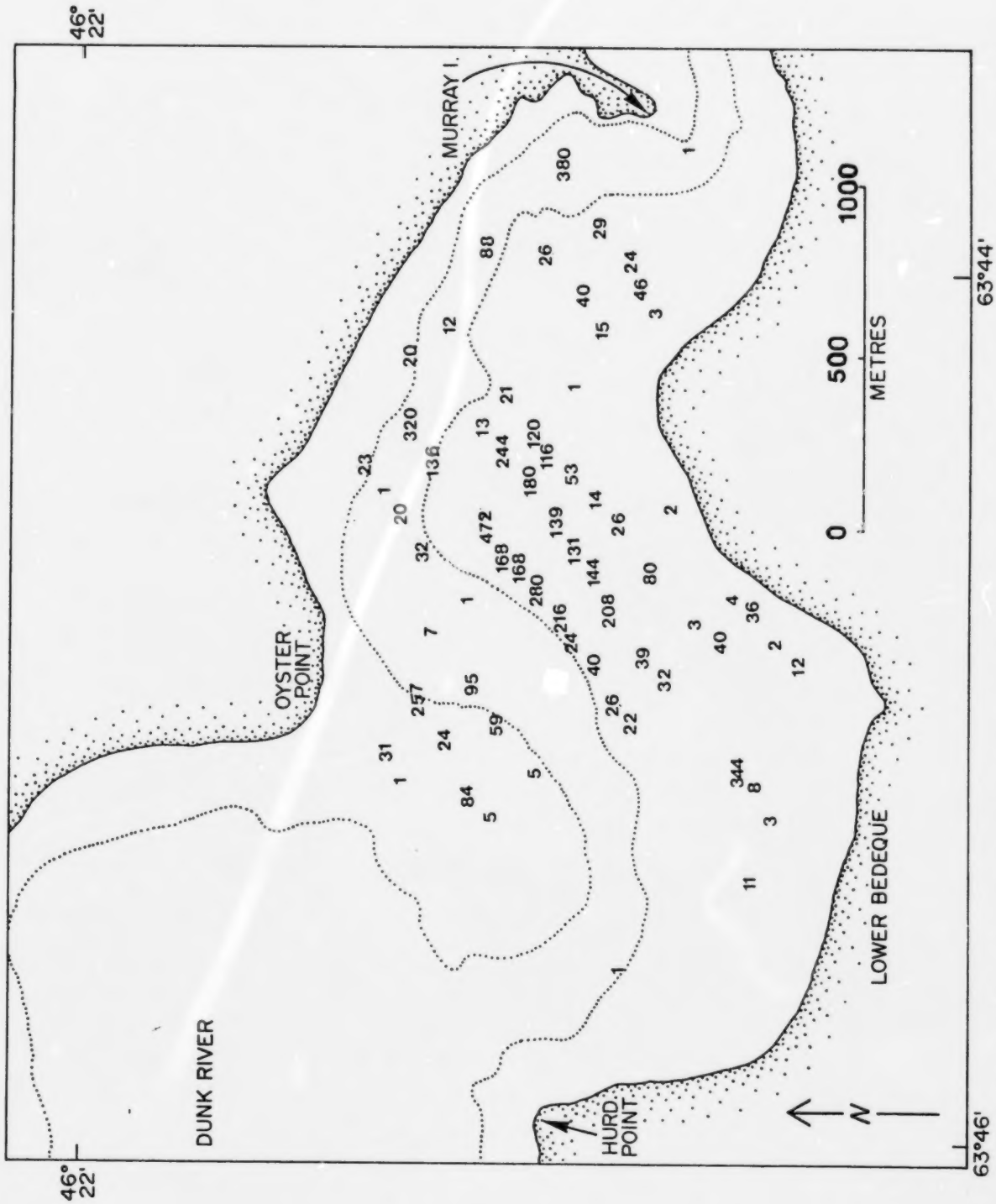


Figure 2. Number of oysters per square metre.

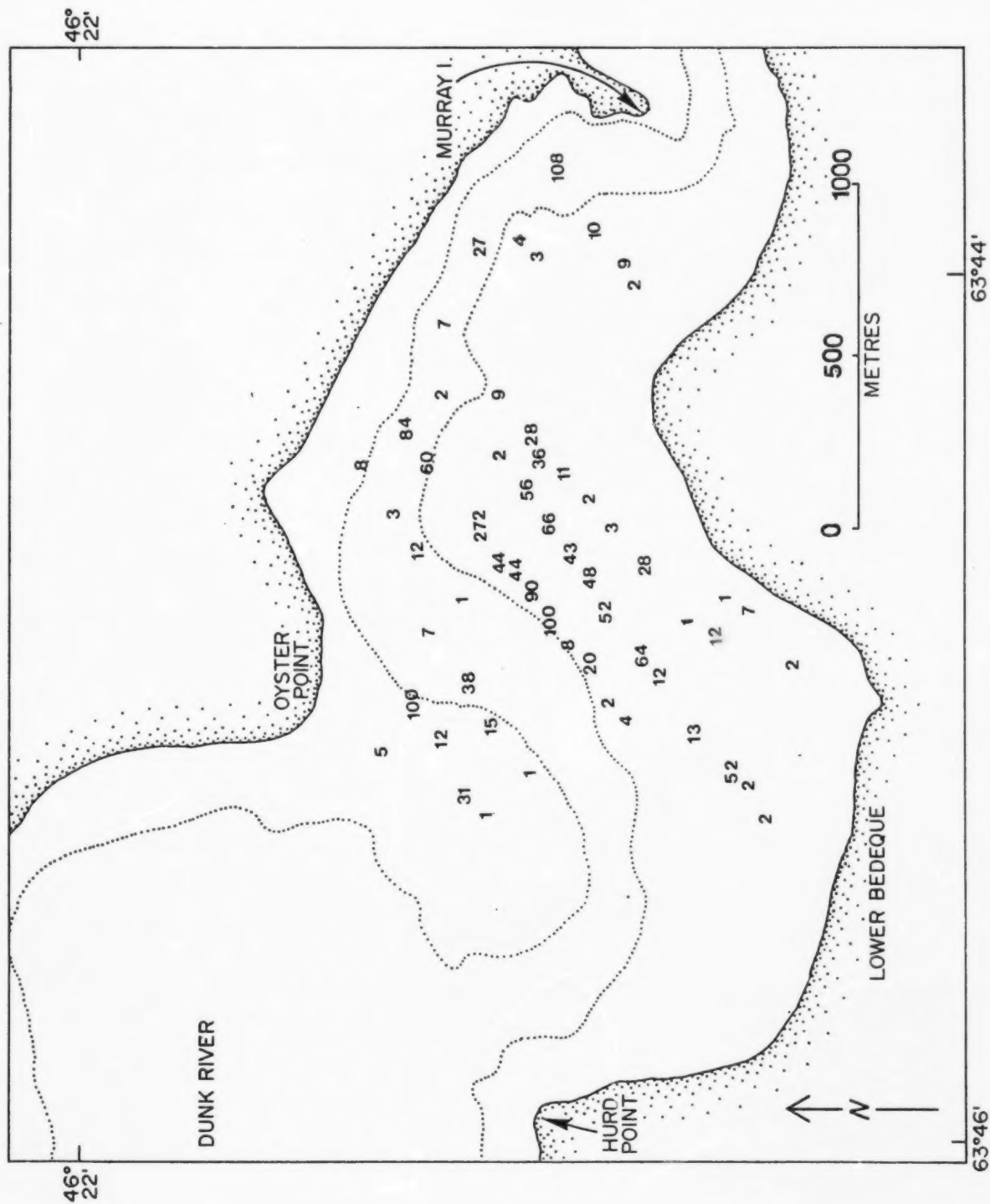


Figure 3a. Density m^{-2} of 1 yr old oysters (<2.5 cm) collected at each station.

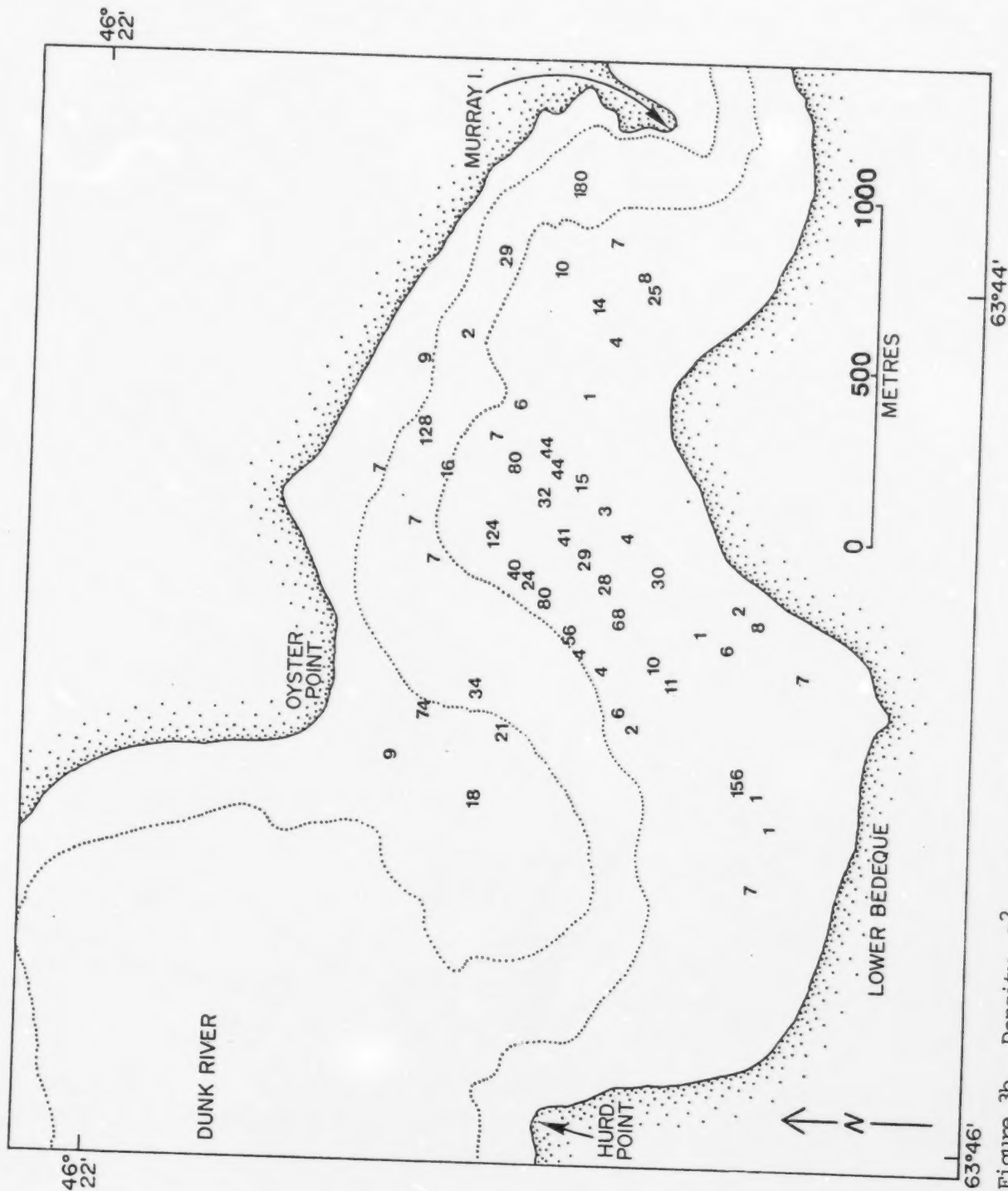


Figure 3b. Density m^{-2} of 2 yr old oysters (2.6-4.5 cm) collected at each station.





63°46' Figure 3c. Density m^{-2} of 3 yr old oysters (4.6 to 6.5) collected at each station.



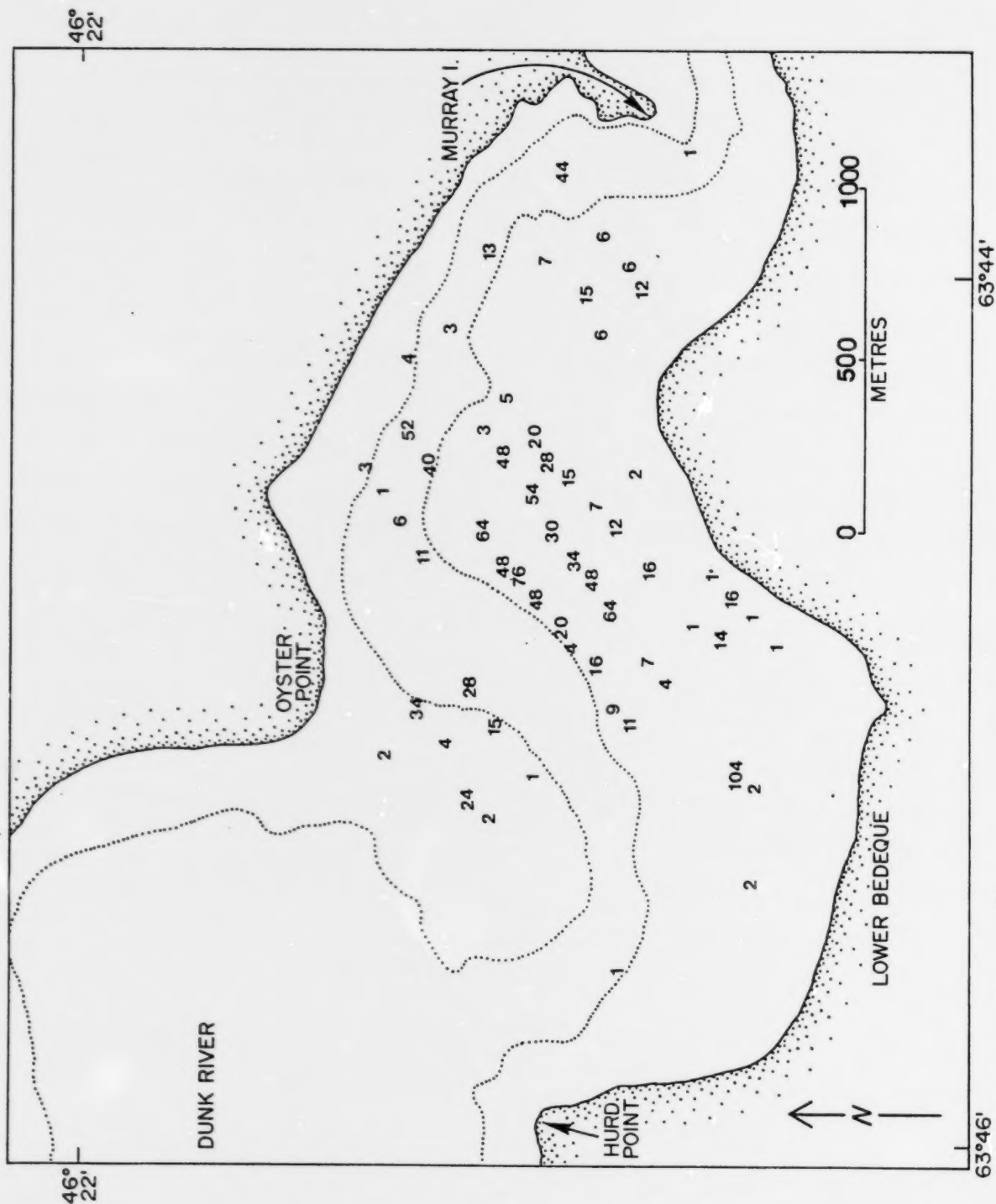


Figure 3d. Density m^{-2} of 4+ yr old oysters (>6.5 cm) collected at each station.



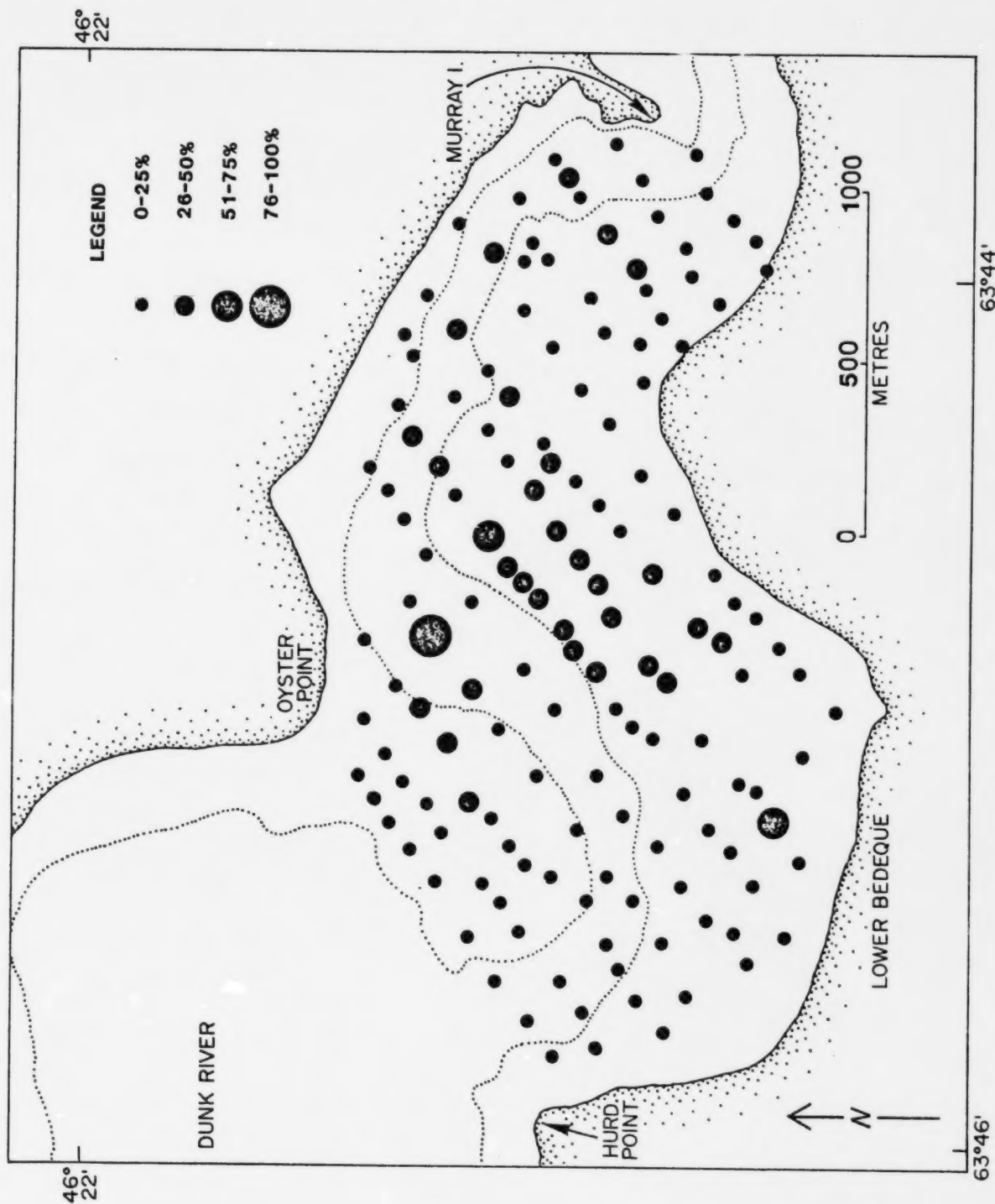


Figure 4a. Percentage of 1 yr old oysters (< 2.5 cm) collected at each station.

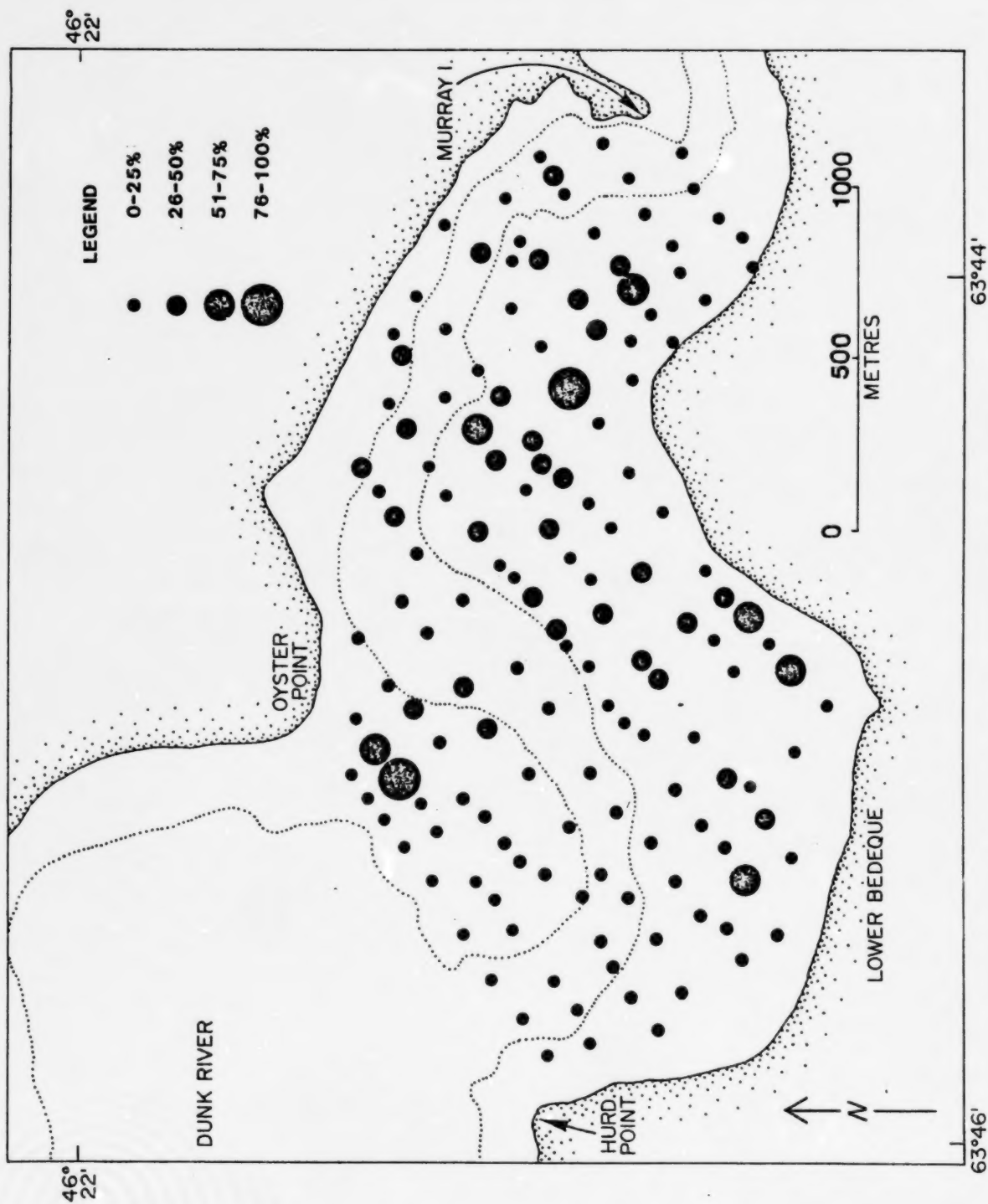


Figure 4b. Percentage of 2 yr old oysters (2.6 to 4.5 cm) collected at each station.

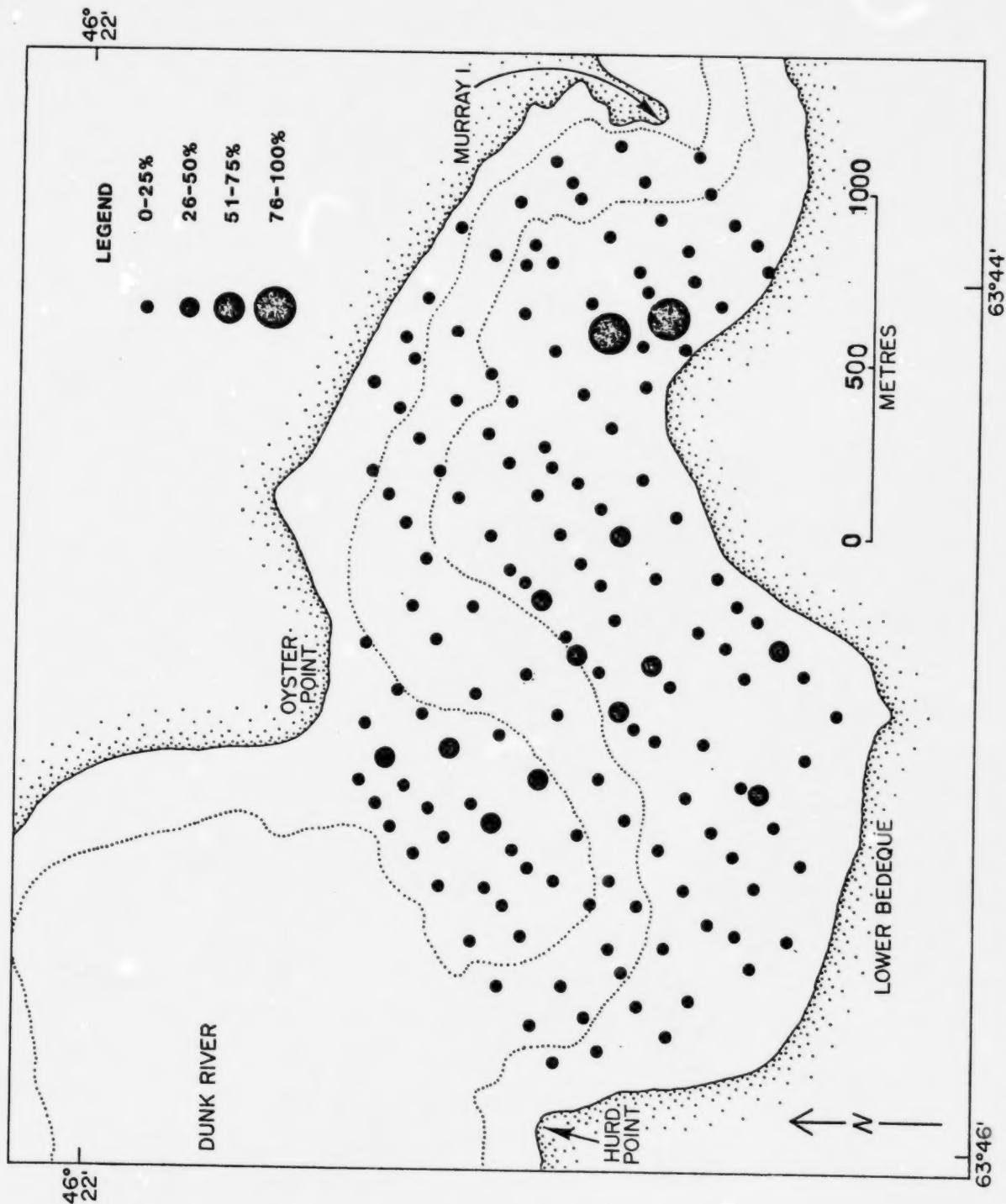


Figure 4c. Percentage of 3 yr old oysters (4.6 to 6.5 cm) collected at each station.

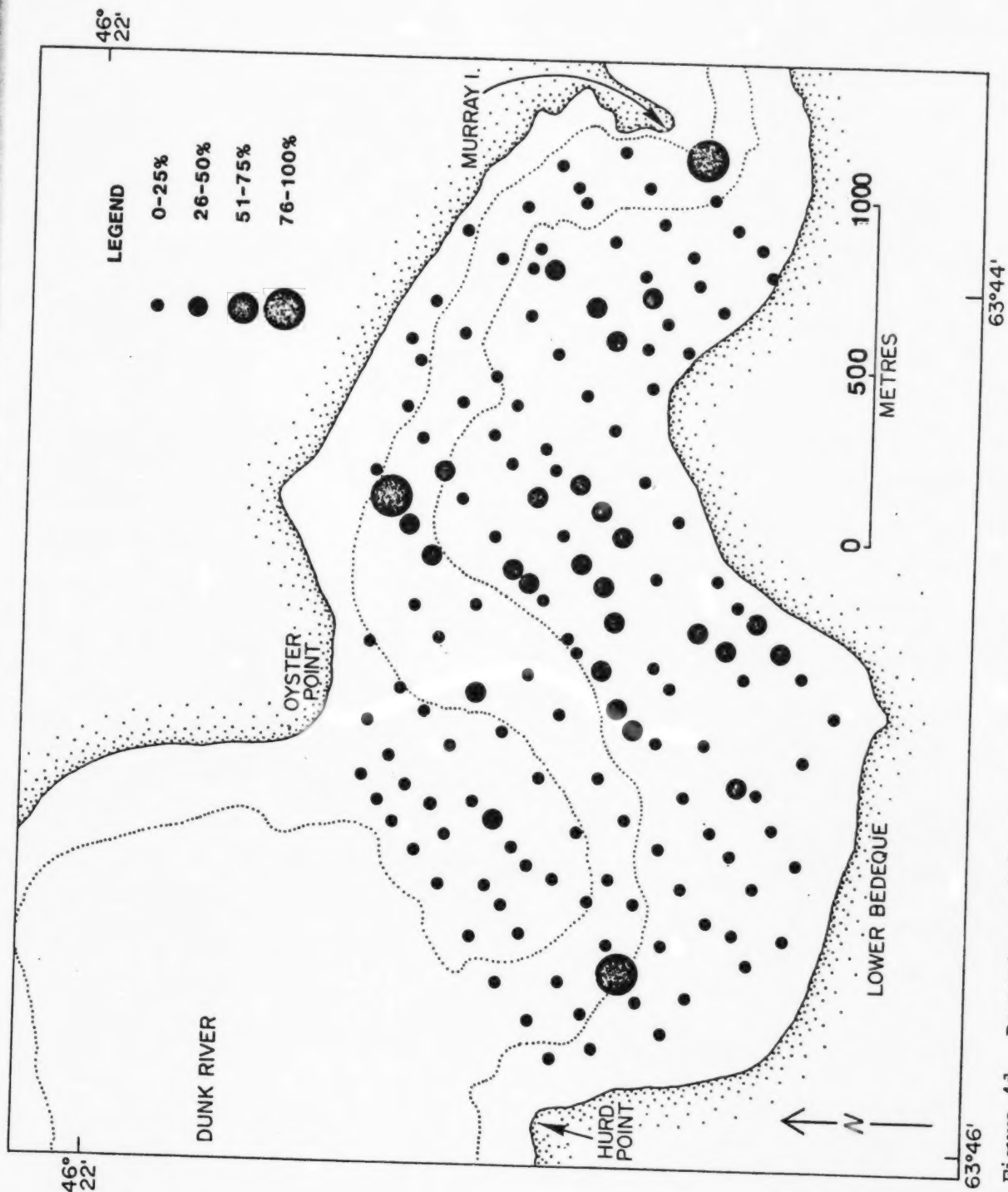


Figure 4d. Percentage of 4+ yr old oysters (>6.5 cm) collected at each station.



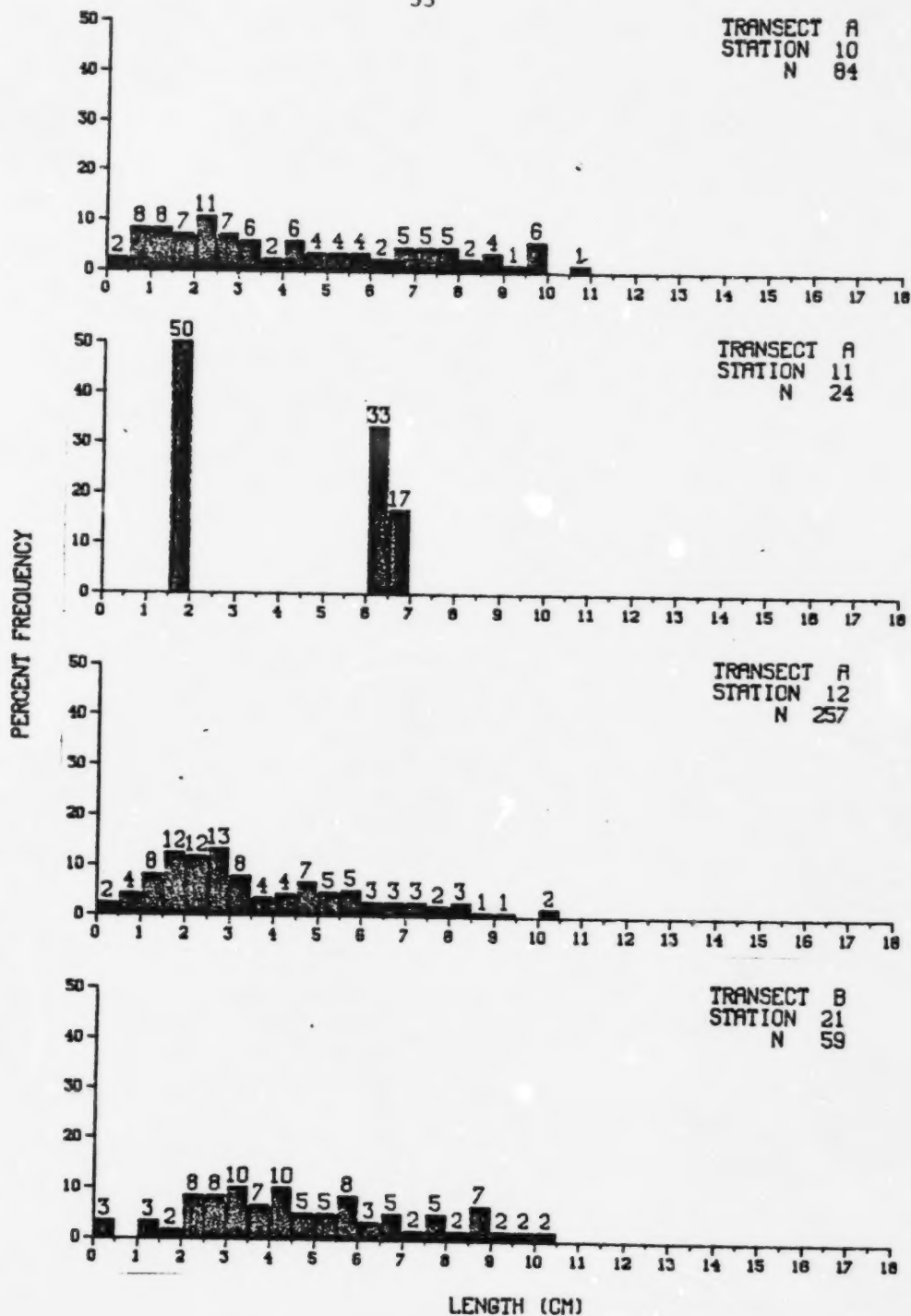


Figure 5. Size frequency distribution of oysters collected at each station in 1972: 1 yr olds < 2.5 cm in length, 2 yr olds 2.6-4.5 cm, 3 yr olds 4.6-6.5 cm and 4,+ yr olds >6.5 cm.



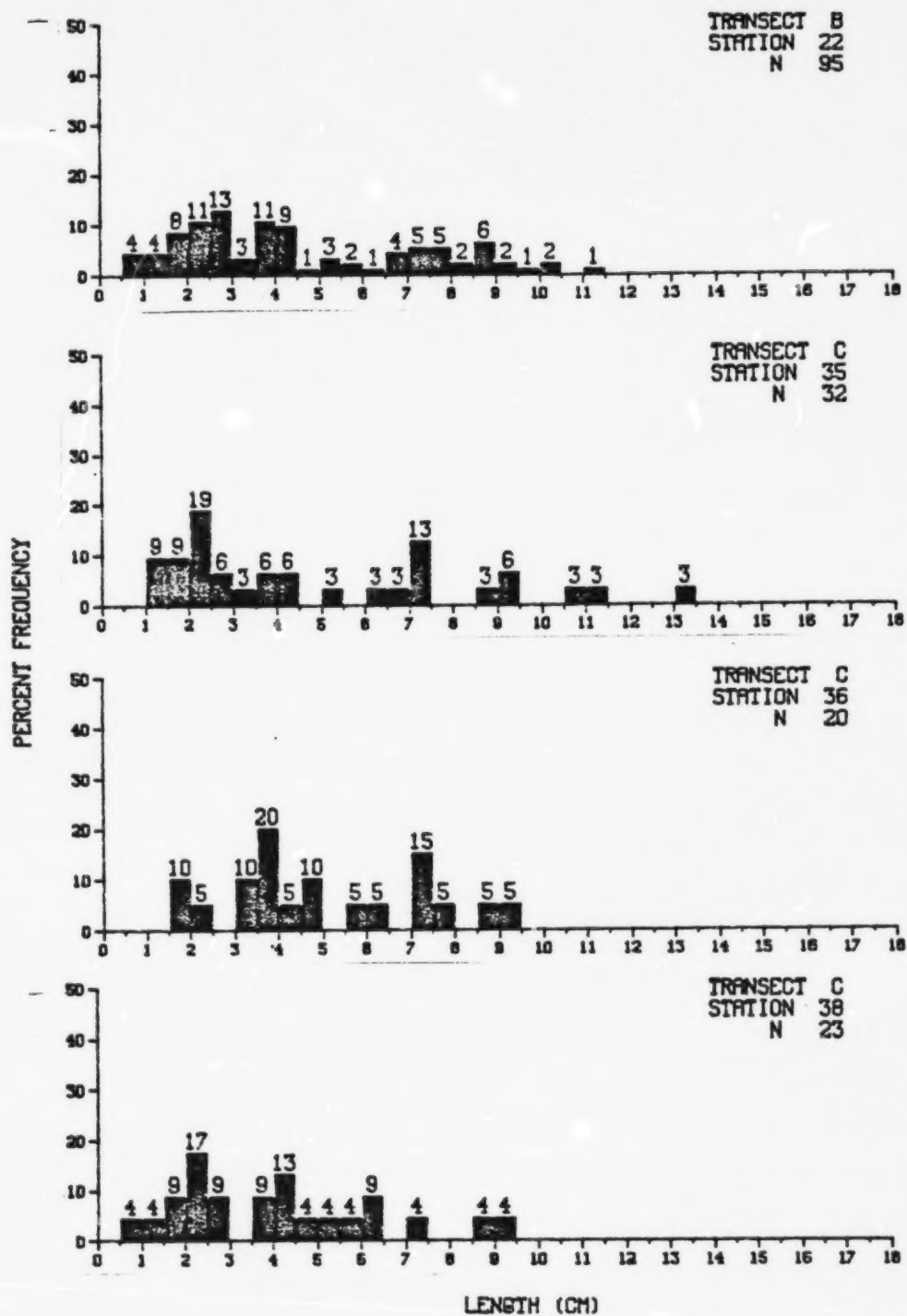


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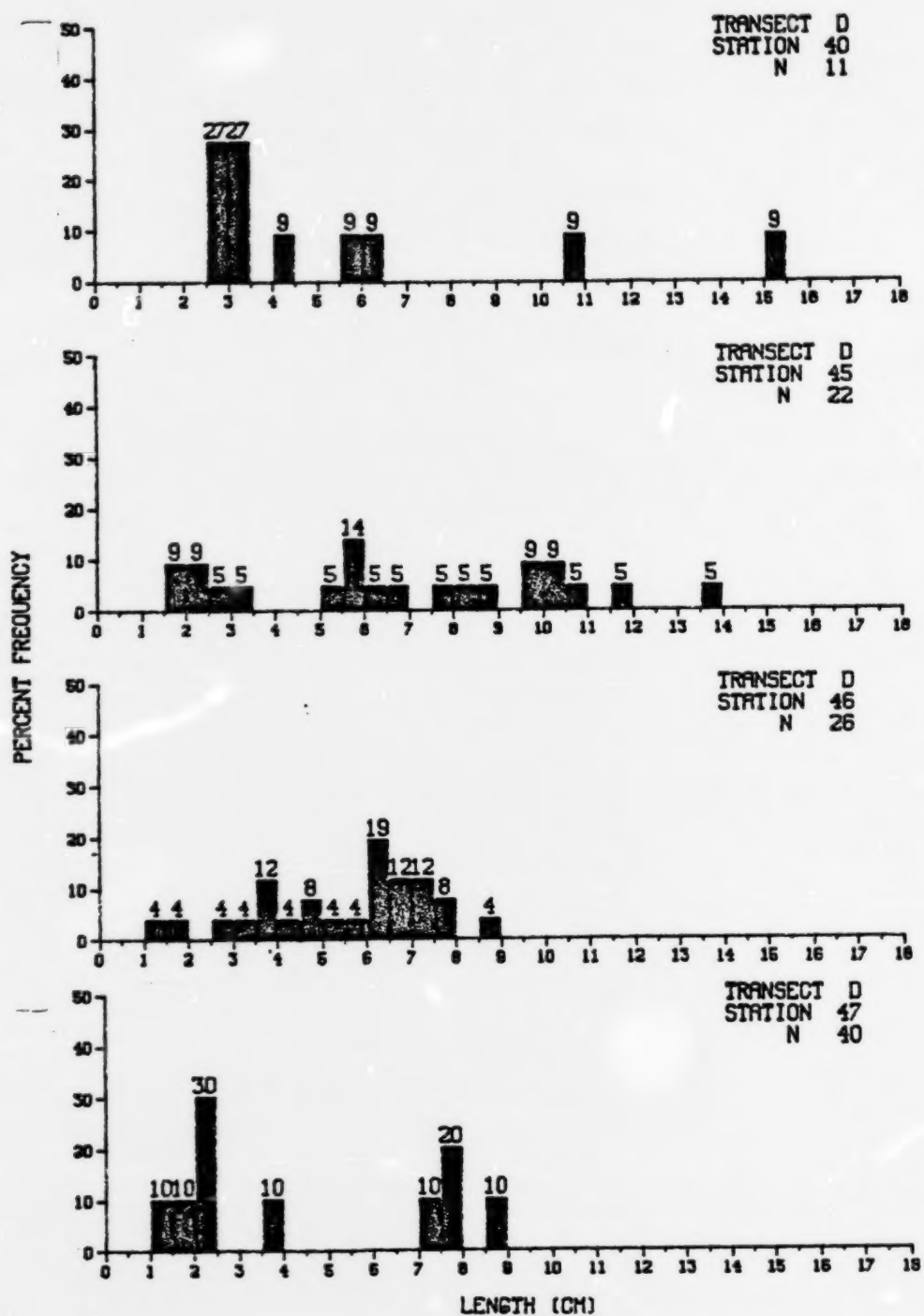


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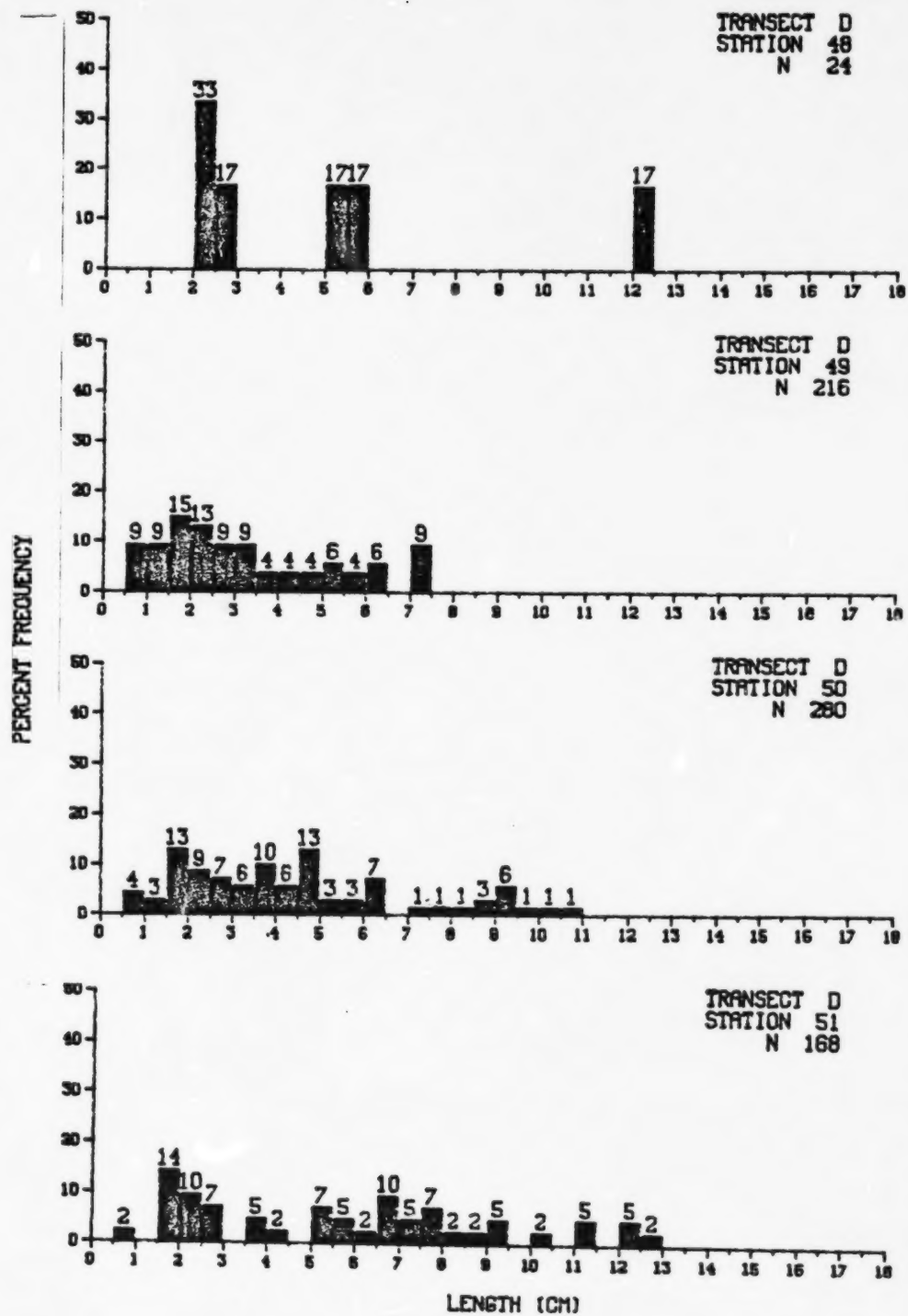


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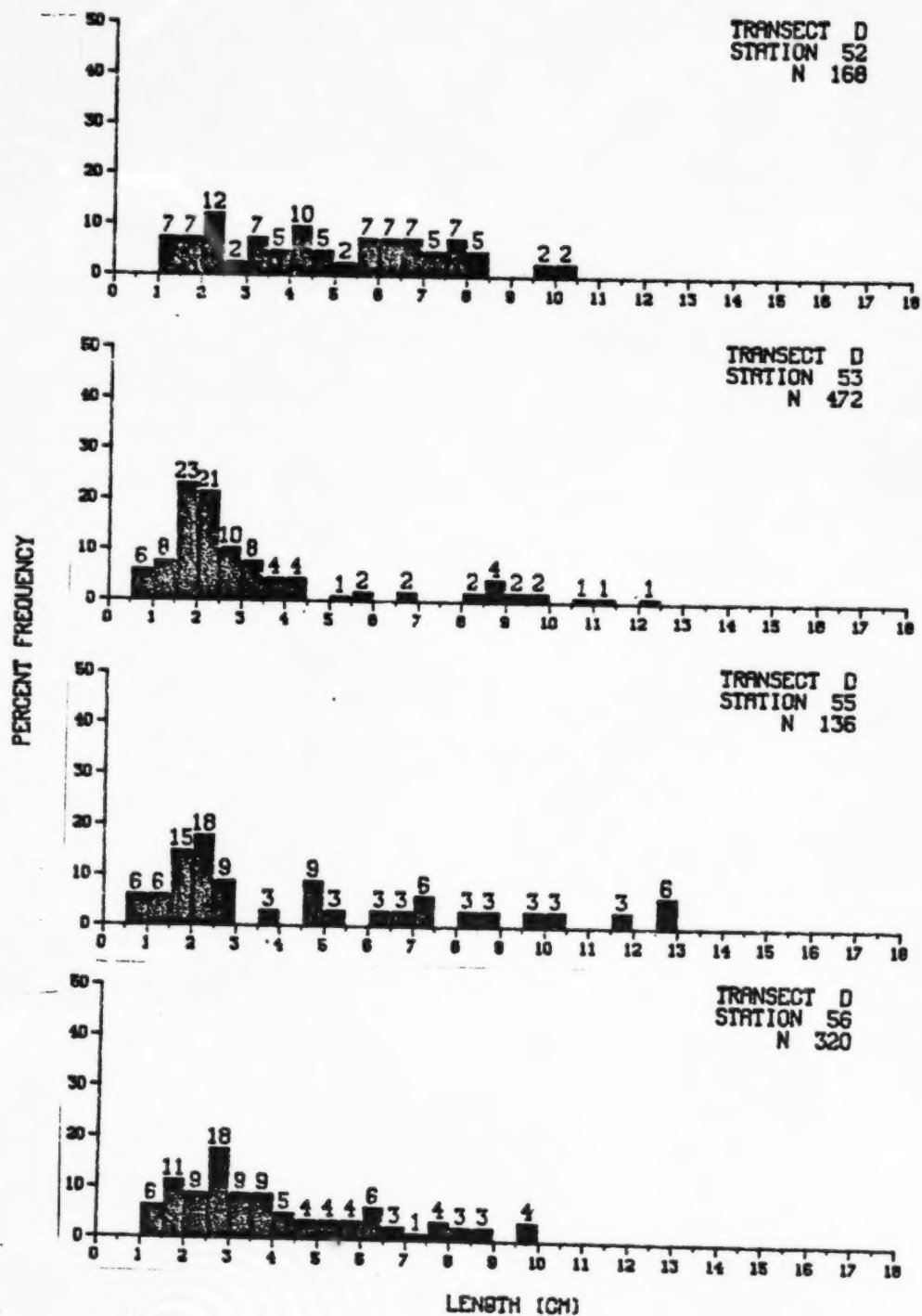


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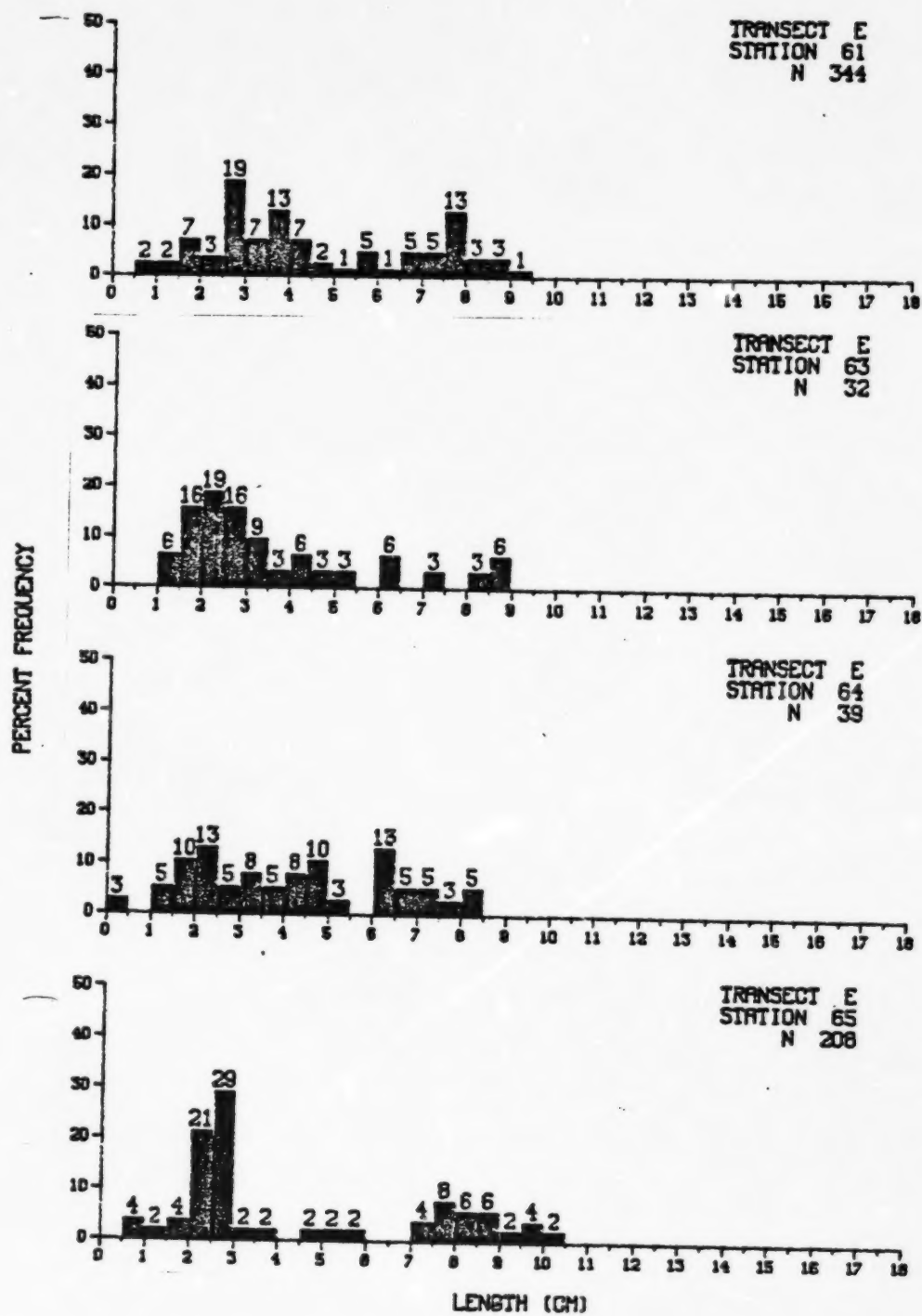


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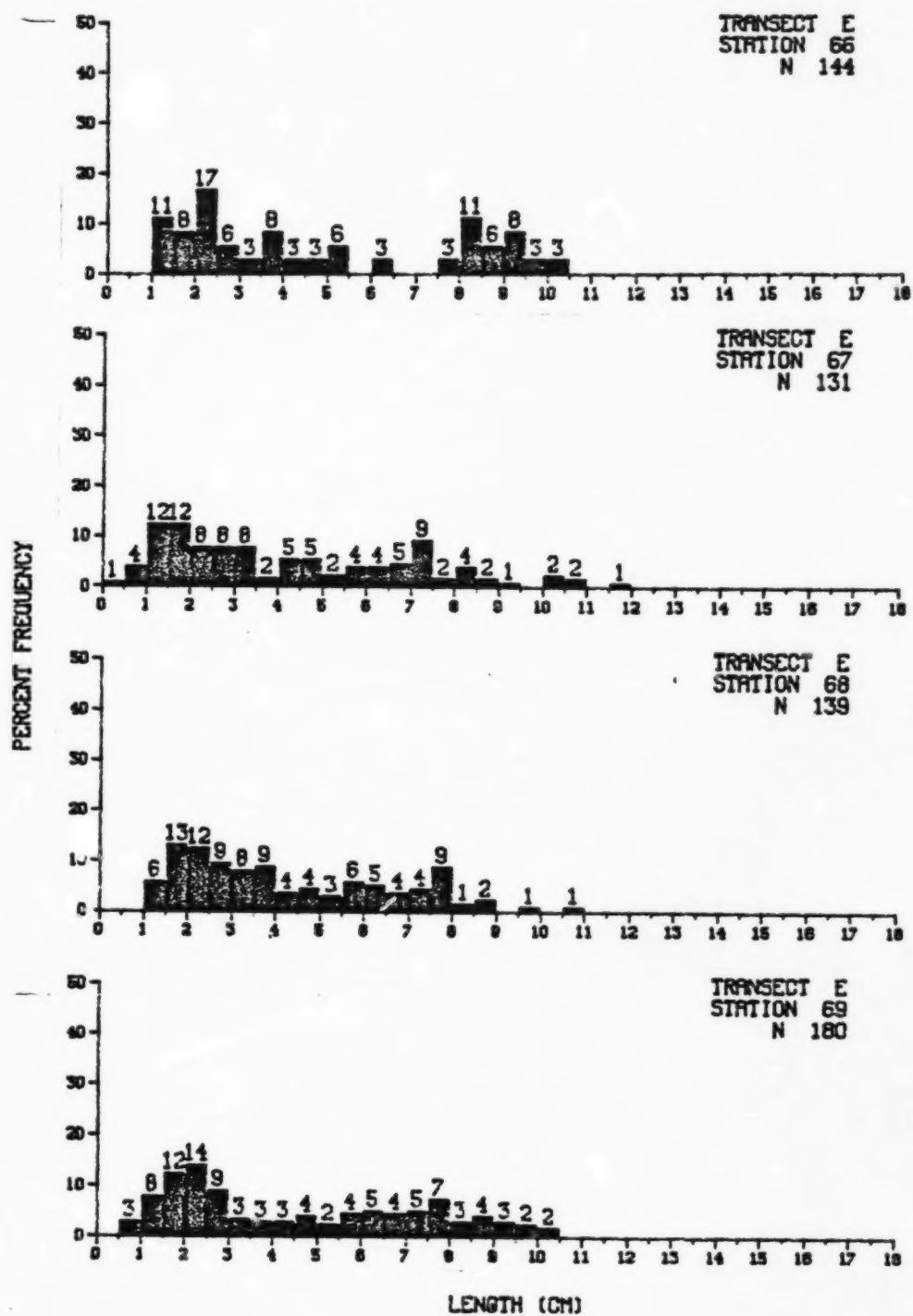


Figure 5. Cont'd.



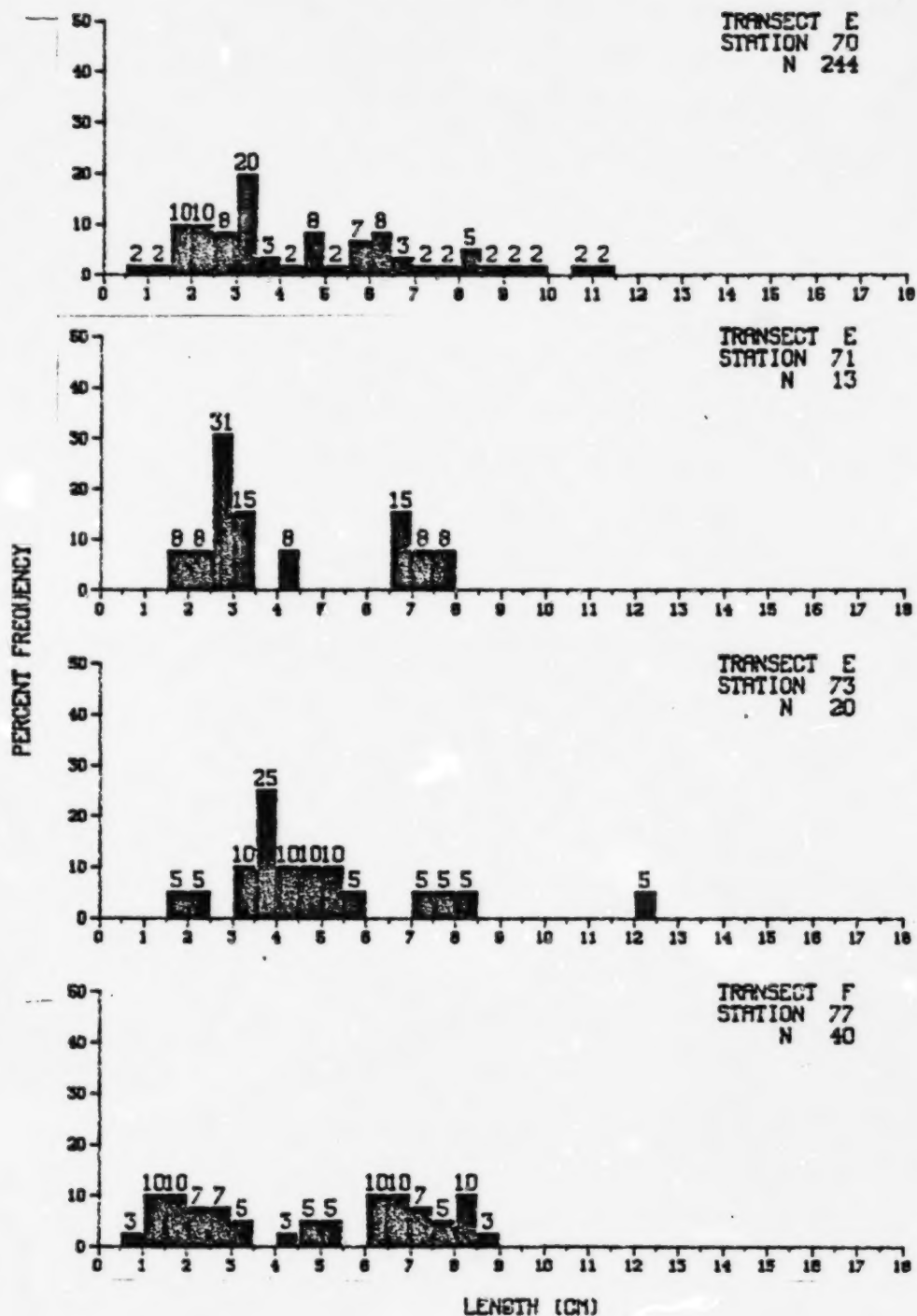


Figure 5. Cont'd.

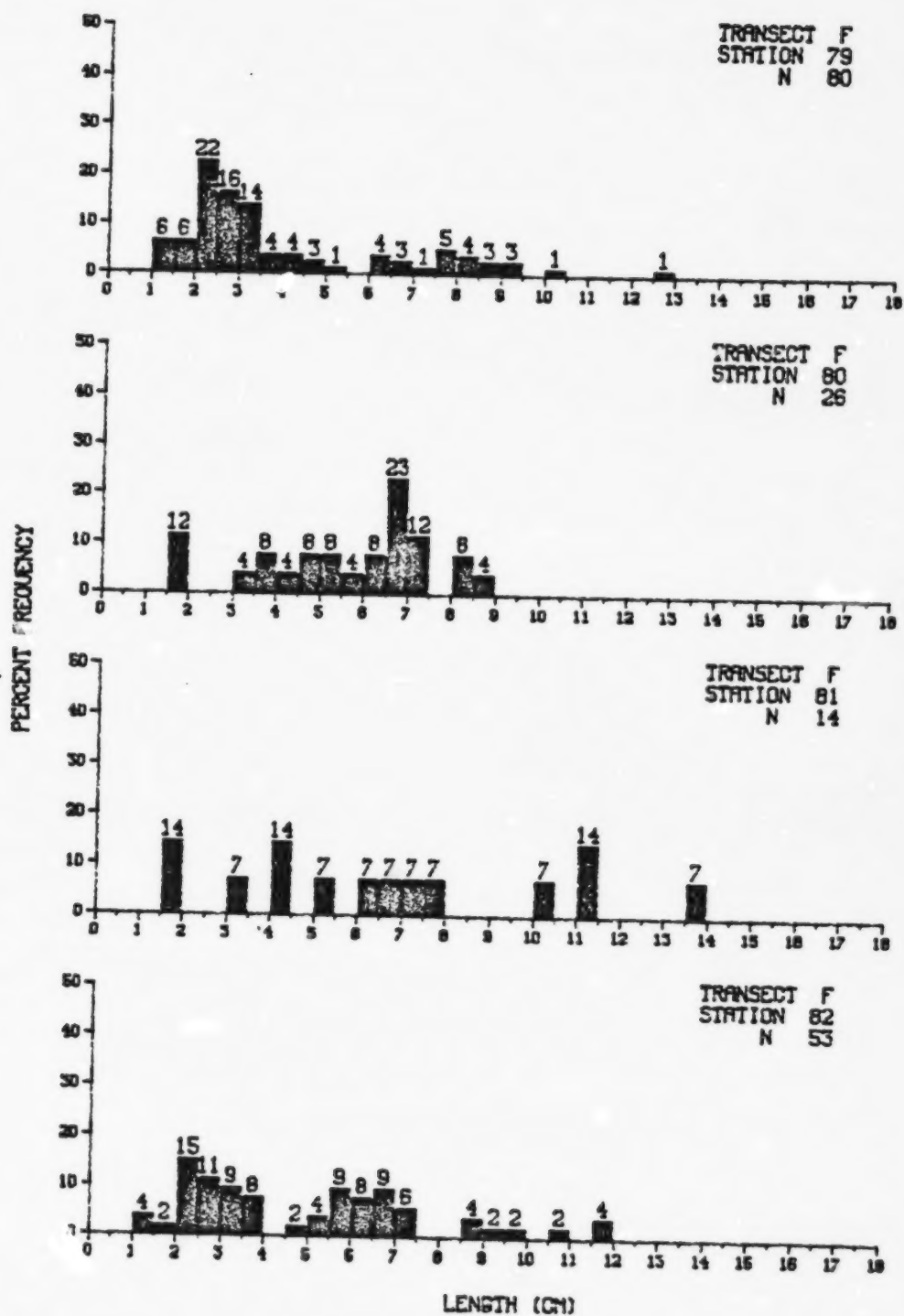


Figure 5. Cont'd.



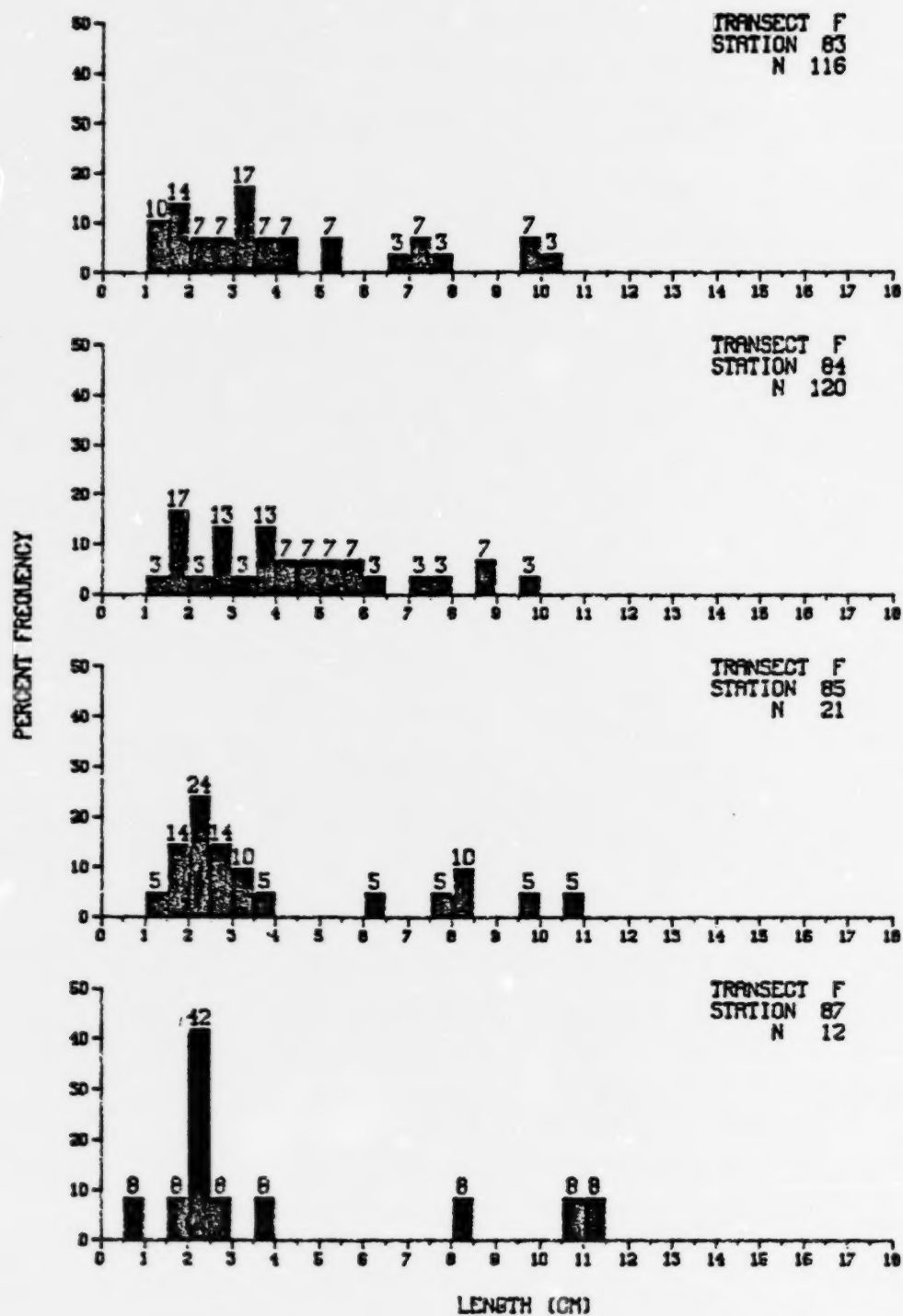
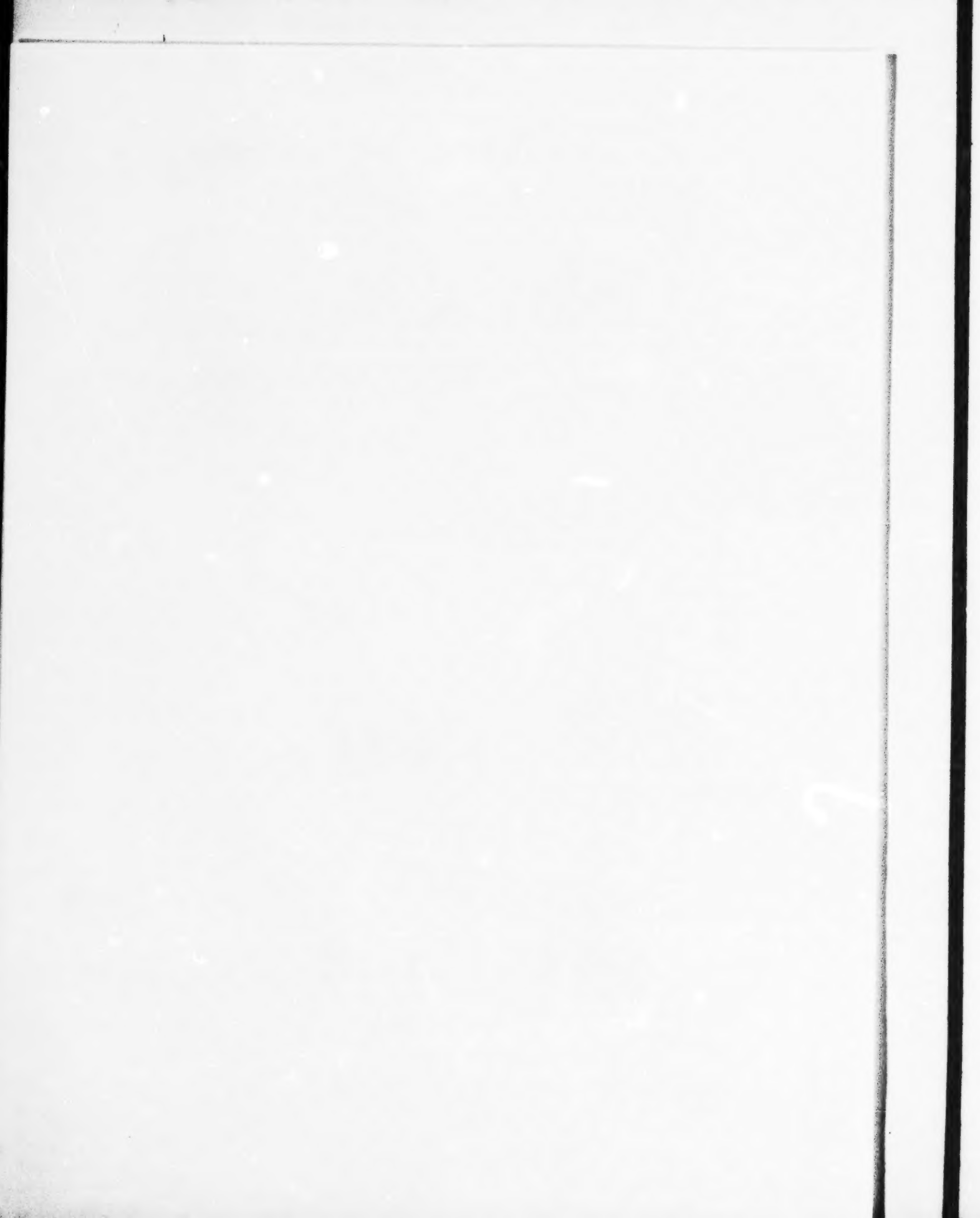


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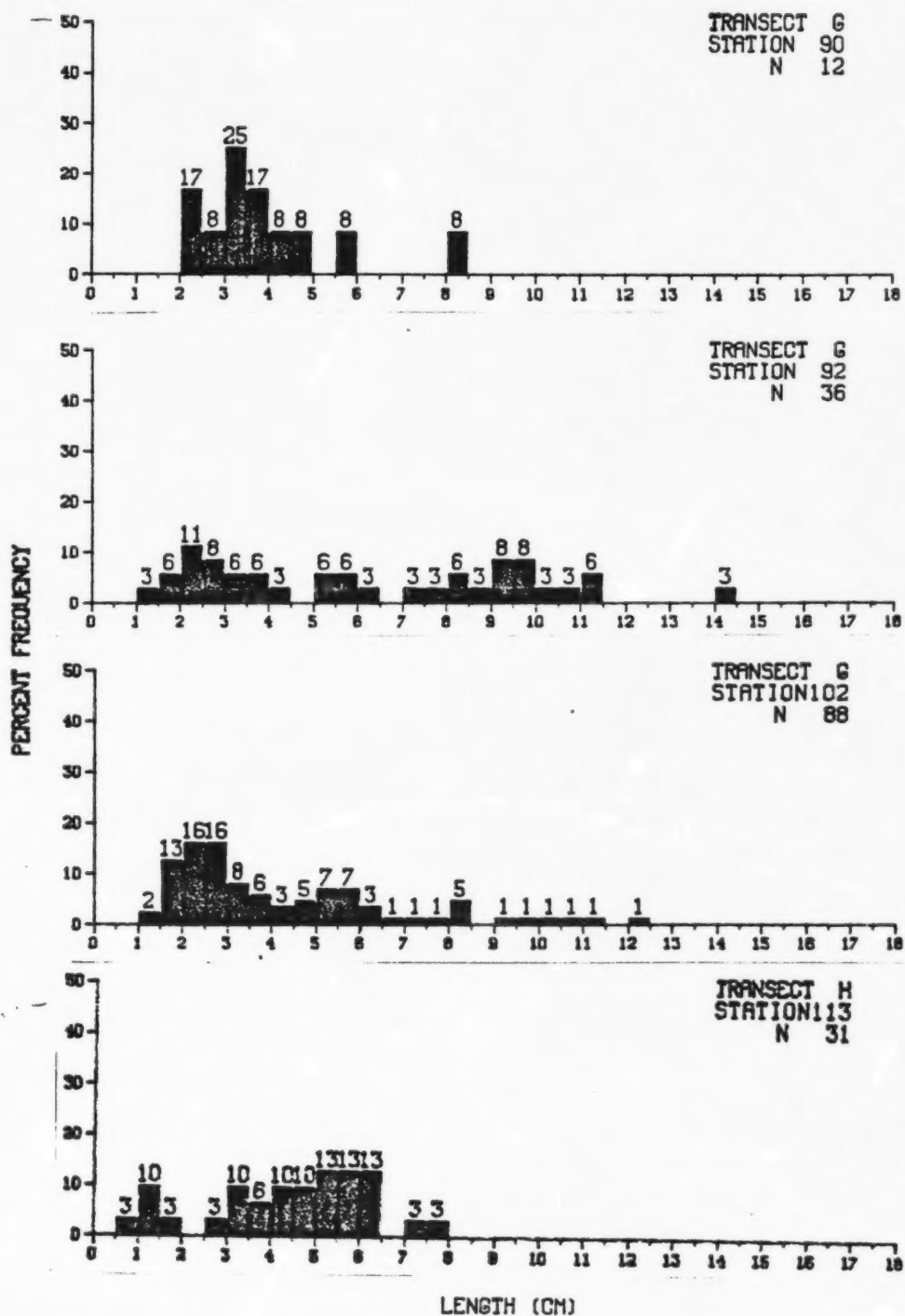


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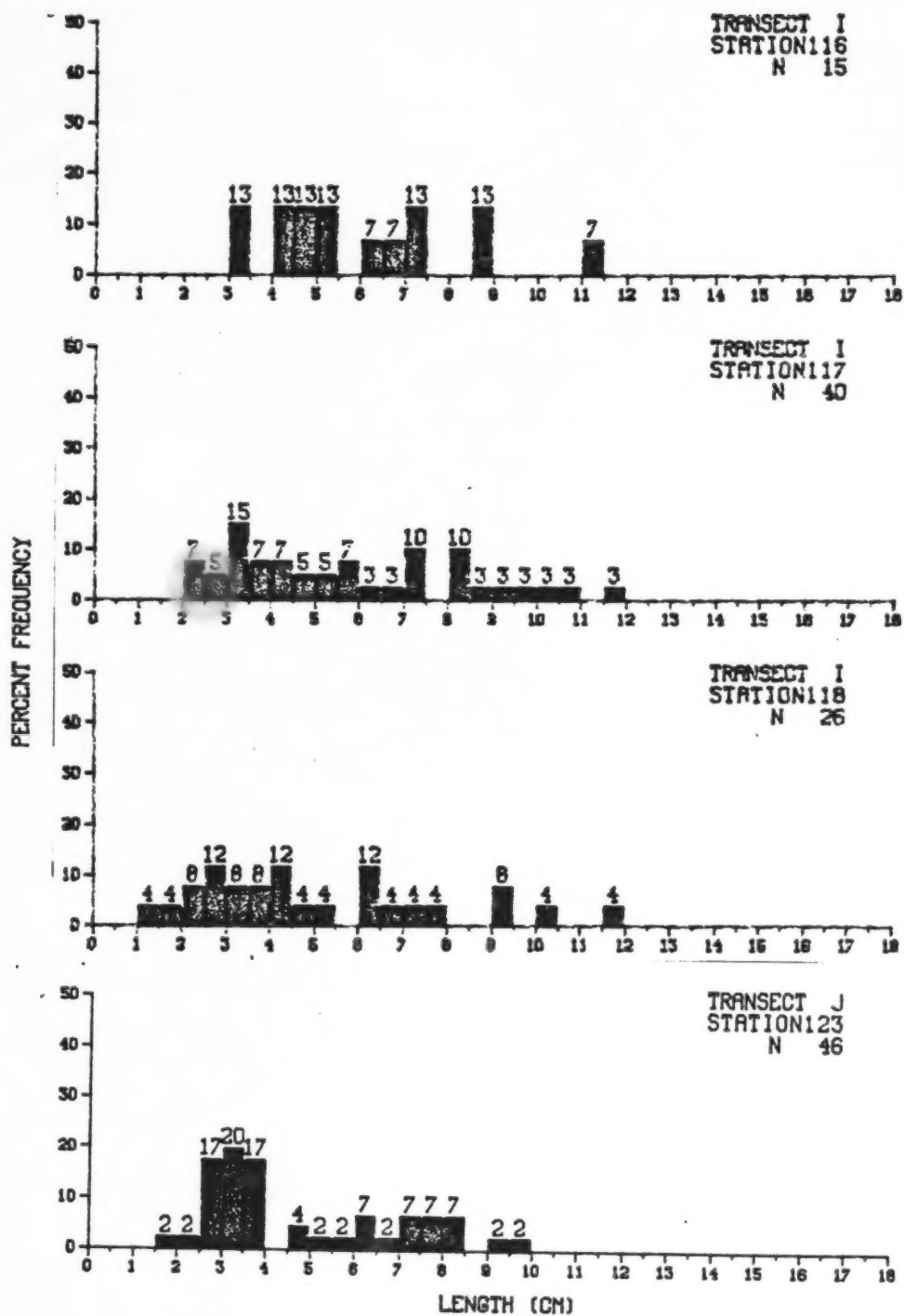


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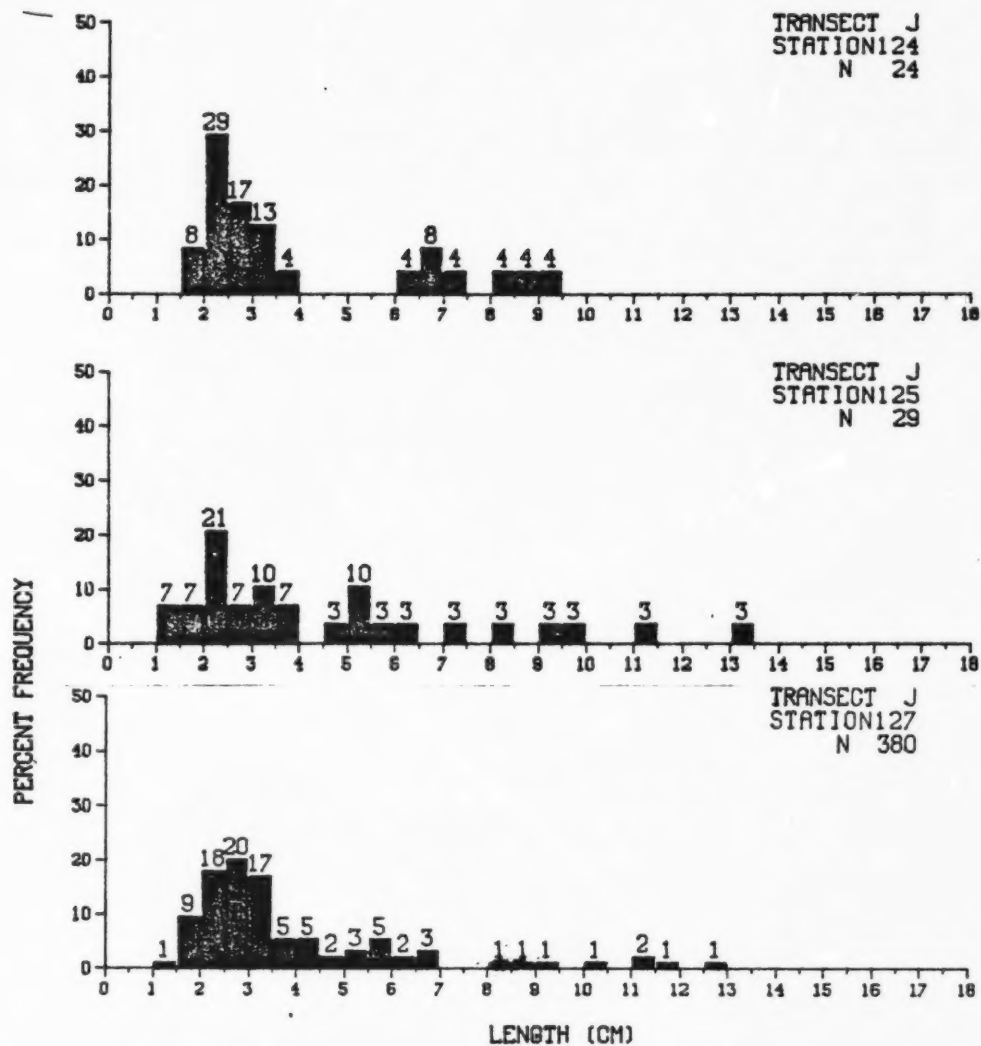


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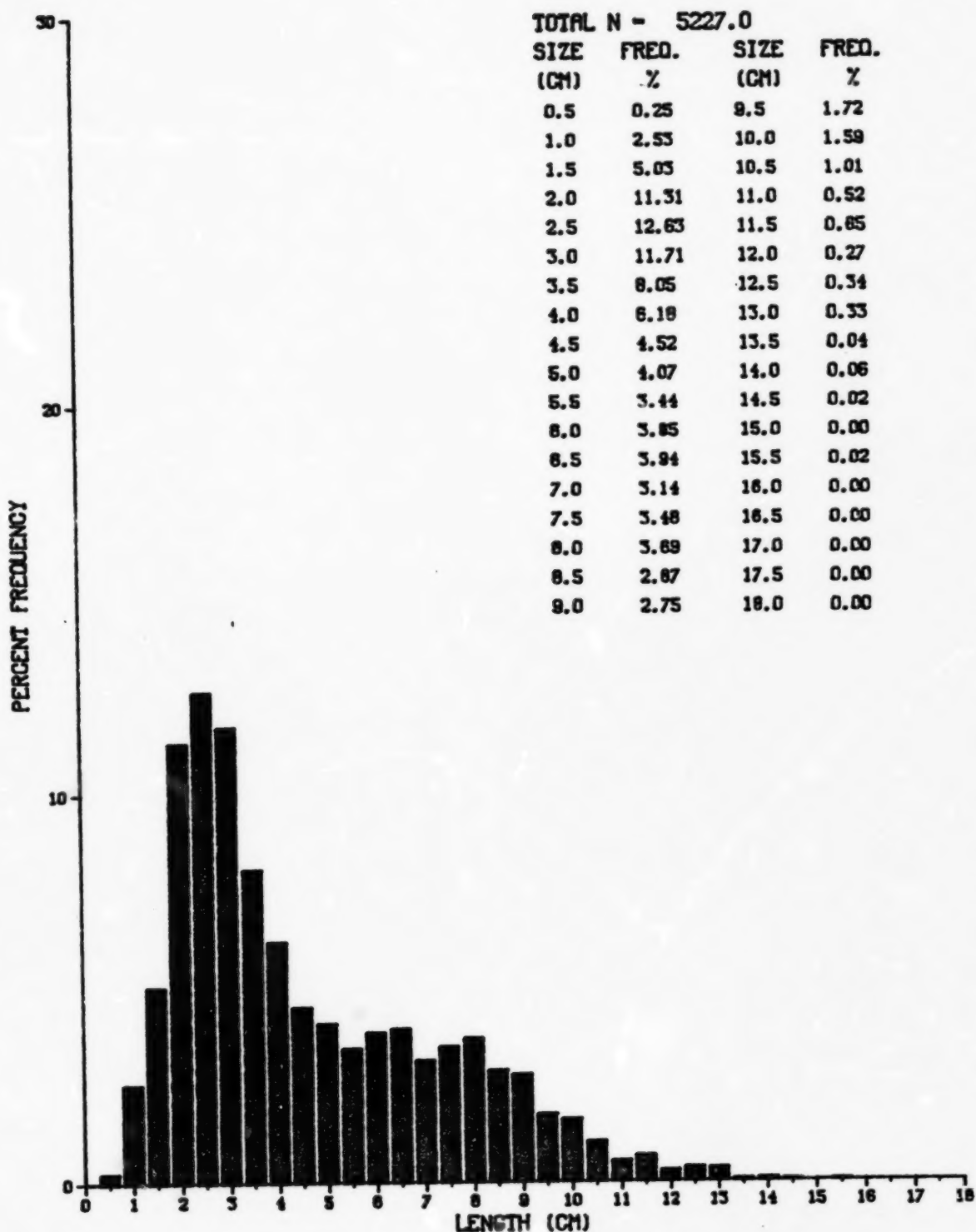


Figure 6. Size frequency distribution of oysters collected over all stations in 1972: 1 yr olds < 2.5 cm in length, 2 yr olds 2.6-4.5 cm, 3 yr olds 4.6-6.5 cm and 4,+ yr olds >6.5 cm.